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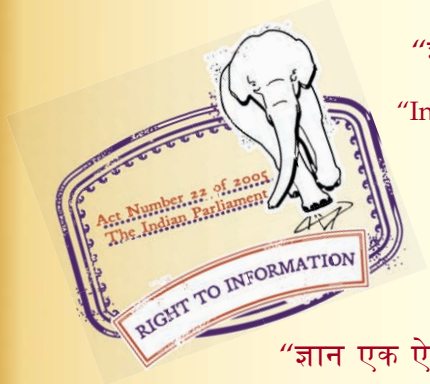

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IS : 4374 - 1980
(Reaffirmed 2002)

Indian Standard

SPECIFICATION FOR MILD STEEL FABRICATED VERTICAL BOLLARDS WITH AND WITHOUT LUGS

(First Revision)

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Indian Standard

SPECIFICATION FOR MILD STEEL FABRICATED VERTICAL BOLLARDS WITH AND WITHOUT LUGS

(First Revision)

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Indian Standard

SPECIFICATION FOR MILD STEEL FABRICATED VERTICAL BOLLARDS WITH AND WITHOUT LUGS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 29 February 1980, after the draft finalized by the Shipbuilding Sectional Committee had been approved by the Marine, Cargo Movement and Packaging Division Council.

0.2 Bollards form a part of the mooring outfit required on board ships. The nominal size of mild steel fabricated vertical bollards for the ship is based on the admissible breaking load of the corresponding rope specified by the competent authority under whose rules the vessel is constructed.

0.3 Fabricated bollards are required to be provided with lugs when they are fitted in certain positions on board ships. Bollards fitted in other positions, may or may not be provided with lugs, depending on the requirements.

0.4 The revision of this standard has been undertaken to bring it in line with the work done at ISO level. Moreover, the testing of bollards has also been included in this revision.

0.5 While preparing this standard, assistance has been derived from:

ISO 3913-1977 Shipbuilding — Welded steel bollards. International Organization for Standardization.

JIS F 2001-1975 Bollards. Japanese Industrial Standards Committee.

0.6 This standard is one of a series of Indian Standards on bollards. Other standards in the series are as follows:

IS : 3381-1965 Cast vertical bollards with and without lugs

IS : 5240-1969 Cast skew bollards

IS : 5625-1970 Cast cruciform bollards

0.7 As a guidance, the design basis for bollards is given in Appendix A.

0.8 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard specifies the material, dimensions and testing of mild steel fabricated vertical bollards with and without lugs of nominal size from 100 to 800 mm.

1.1.1 The method of construction and details of welding are not specified in this standard but the manufacturer shall ensure that the bollards are capable of withstanding the test requirements specified.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definition shall apply.

2.1 Nominal Size — The nominal size of a bollard shall be denoted by a reference to the outside diameter of the barrel in terms of the nearest number drawn from a basic series of preferred numbers.

3. MATERIAL

3.1 The bollard shall be made from weldable quality steel conforming to IS : 2060-1969†.

4. CONSTRUCTION

4.1 The barrels shall be constructed from steel tubes or formed from plate and longitudinally welded.

4.2 The thickness of the plates for the base shall be sufficient to withstand the loading imposed by the barrels.

4.3 Consideration shall be given to the length and breadth of the base to ensure that there is an adequate area of fillet weld attachments to the deck to withstand the applied loading (*see* Table 1).

4.4 An oval eye plate conforming to IS : 6225-1971‡ may be fitted to the base plate of a bollard for the purpose of securing a chain or rope stopper.

*Rules for rounding off numerical values (*revised*).

†Specification for structural steel (fusion welding quality).

‡Specification for ship's oval eye plates.

The strength of the eye plate shall be equal to 1/4 of the strength of the maximum load appropriate to the nominal size of the bollard.

4.5 The construction of the mild steel fabricated vertical bollards with and without lugs shall be as shown in Fig. 1. The bollard shall be attached to the deck by a suitable base plate.

4.6 As an alternative, the barrel may also be directly welded to the deck plate, and the base may then be welded to the barrel and deck plate. In this case the strengthening webs attaching the barrel to the base may be omitted (*see* Fig. 2).

5. DIMENSIONS

5.1 The dimensions of mild steel fabricated vertical bollards with and without lugs shall be as given in Table 1 read with Fig. 1.

6. TOLERANCES

6.1 Tolerance on outside diameter of barrels whether made of plate or tube shall be $\pm$ 1 percent.

6.2 The material thickness of barrel shall not be less than that specified in Table 1.

6.3 The tolerance on other dimensions shall be according to coarse series of IS : 2102-1962*.

7. WORKMANSHIP AND FINISH

7.1 All surfaces of the bollard including welds shall be free from any visible flaws or imperfections.

7.2 All surfaces in contact with the ropes shall be free from surface roughness or irregularities likely to cause damage to the ropes by abrasion.

7.3 After completion the bollards shall be coated externally with an anti-corrosive protective finish.

8. TESTS

8.1 Each nominal size of the bollard shall be type tested in accordance with **8.1.1** and **8.1.2** by the manufacturer for the approval of design and construction adopted.

---

*Recommendations for machining deviations for dimensions without specified tolerances.

TABLE 1 DIMENSIONS AND MAXIMUM LOADING OF WELDED BOLLARDS

(*Clauses* 4.3, 5.1, 6.2, 8.1.1 *and* 8.1.2 and *Fig.* 1)

All dimensions in millimetres.

Nominal Size *DN*	Barrel						Base				Lug			Maximum Working Load of Single Rope, Tonnes
	D	D_1	*t* (Nominal)		h_1	l_1	h_2	l_2	l_3	t_1	h_3	*g*	*r*	
			Tube 360 N/mm² *Min*	Plate 360 N/mm² *Min*										
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
100	114·3	130	10	10	150	250	75	450	150	5	—	—	—	3
125	139·7	160	10	10	190	315	80	560	190	5	—	—	—	4
160	168·3	200	10	10	250	400	90	720	250	6	—	—	—	5
200	219·1	250	12·5	10	300	500	100	900	300	8	—	—	—	8
250	273·0	305	14·2	12	380	630	125	1 130	380	10	160	60	80	12
315	323·9	365	17·5	16	480	800	150	1 430	480	12	190	70	105	20
400	406·4	480	—	19	600	1 000	175	1 800	600	14	225	90	140	32
500	508·0	600	—	22	750	1 200	200	2 250	750	18	265	100	180	46
630	610·0	740	—	27	900	1 570	225	2 830	940	22	305	110	220	70
710	711·0	820	—	27	1 050	1 750	250	3 200	1 080	25	350	110	240	82
800	813·0	910	—	28	1 200	2 000	275	3 600	1 200	25	380	110	260	100

NOTE 1 — Dimensions h_2, l_2 and l_3 are given for guidance only.

NOTE 2 — The values of maximum working load given in table refer to a single mooring rope one wound in figure-of-eight fashion around the barrels.

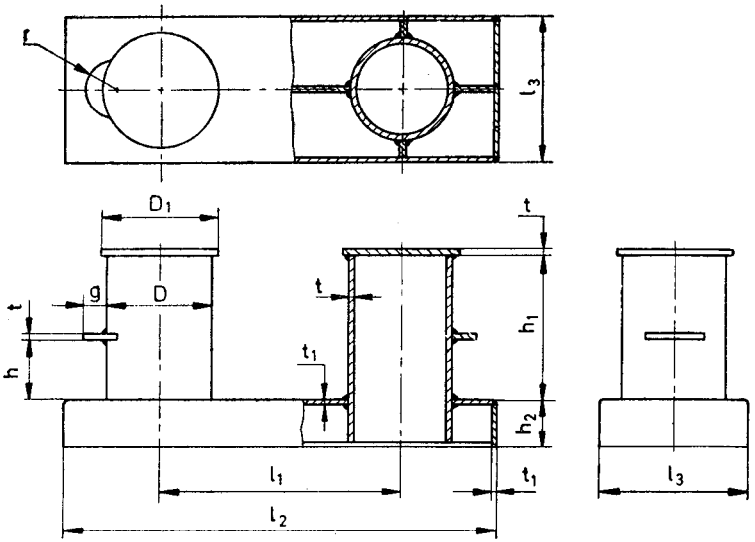

FIG. 1 DIMENSIONS OF MILD STEEL FABRICATED VERTICAL BOLLARDS WITH AND WITHOUT LUG

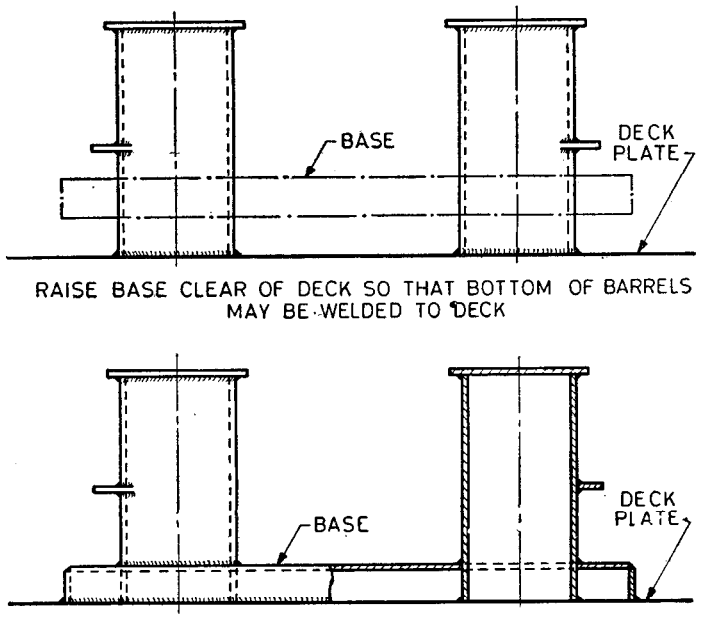

FIG. 2 METHOD OF ATTACHMENT OF BOLLARD DIRECTLY TO DECK

8.1.1 The bollards shall be subjected to test by mounting two ropes appropriate to the loading required in figure-of-eight fashion and inducing load simultaneously in each rope to the value for the nominal size of bollard, given in Table 1.

8.1.2 Simulating the rope loading effect by mounting a single rope on one barrel at a height of 1·2 times the nominal size above the top of the base plate and applying twice the appropriate loading value given in Table 1. This test shall be executed on each barrel, but not simultaneously.

8.2 After the application of test load the bollards shall be examined to ascertain that:

a) no change occurs in the centre-to-centre dimensions (l_1) measured across the top of the barrel,

b) no part of the bollard shows any signs of permanent deformation or failure, and

c) all principal welds are in tact and free from cracks or flaws.

9. DESIGNATION

9.1 Mild steel fabricated vertical bollards shall be designated by name, nominal size with or without lugs and number of this standard.

Example:

A mild steel fabricated vertical bollard with lug of nominal size of 200 shall be designated as:

MS Fabricated Vertical Bollard 200 with Lug IS : 4374

10. MARKING

10.1 Mild steel fabricated vertical bollards shall be marked with nominal size and identification mark of the manufacturer.

10.1.1 The bollards may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

APPENDIX A

(*Clause* 0.7)

BASIS FOR DESIGN OF WELDED STEEL BOLLARD

A-1. LOADING

A-1.1 The bollard is designed for either of the conditions stated in **A-1.1.1** and **A-1.1.2**.

A-1.1.1 To withstand the loading imposed by two mooring ropes each of the breaking load L wound in figure-of-eight fashion (about five turns a barrel) (*see* Fig. 3).

NOTE — In mooring practice only one mooring rope is fitted per barrel.

A-1.1.2 To withstand the loading imposed by a single rope (using a soft loop) having twice the breaking load L mounted at a maximum height of 1·2 times the nominal size above the baseplate (*see* Fig. 3).

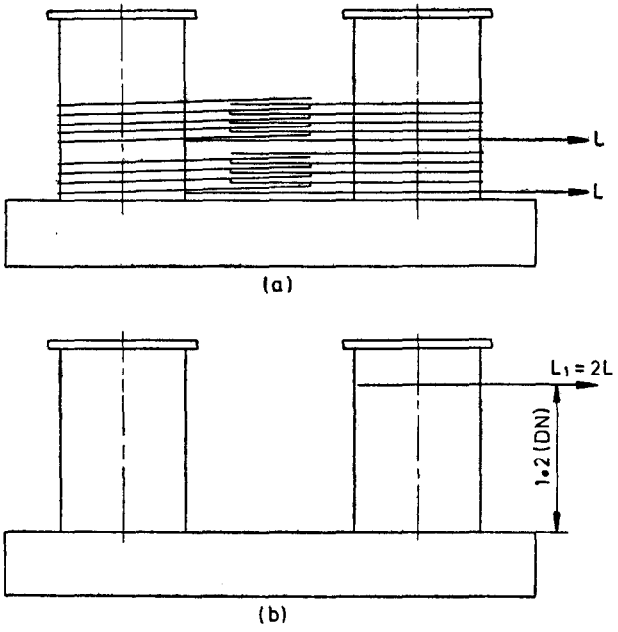

FIG. 3 BASIS FOR DESIGN OF WELDED STEEL BOLLARDS

A-1.1.3 The loading L imposed by the single rope wound in figure-of-eight fashion around a barrel produces a resultant loading of approximately $2L$. For a case stated in **A-1.1.1** twice this value (that is $4L$) is used in the design calculations.

A-2. DESIGN STRESS VALUE

A-2.1 For bending, the stress is limited to 85 percent of the yield value of the material used and for shear the stress is limited to 60 percent of the yield value of the material used.

A-3. STRESS CALCULATION

A-3.1 Within the loading parameters set out in **A-1.1.1** and **A-1.1.2** the criterion of strength of a barrel is fixed by shear stress considerations. The maximum shear stress in N/mm² for a barrel section is obtained from the following formula:

$$f_S, Max = \frac{32\,L}{\pi\,(D_A{}^2 - d_A{}^2)}$$

where

L = breaking load of a single rope in newtons;

D_A = outside diameter of barrel, minus dimensional allowances in millimetres; and

d_A = internal diameter of barrel:

$(D - 1\%) - 2\,(t - 12{\cdot}5\%)$ (for tube)

$(D - 1\%) - 2\,(t - 3\%)$ (for plate)

A-4. LOADING VARIATIONS

A-4.1 There are number of different ways in which mooring ropes and single eye may be secured to a bollard. Whatever the combination of attachments, the user should ensure that the stresses induced in the barrels do not exceed the maximum shear stress given in **A-3**.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N = 1 kg. m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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